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# Factors Influencing Gelation and Rennetability of Camel Milk using Camel Chymosin

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## ABSTRACT

Effect of temperature (T), pH and chymosin (CHY-MAX®M) concentration (CC) on caseinomacropeptide (CMP) release and gelation of camel milk was studied. Results revealed significant ($p< 0.05$) effects of T, pH and CC on the rate of κ-casein (κ-CN) hydrolysis and the interaction between T and CC significantly ($p<0.05$) affected gel development. A high level of CC (85 IMCU $L^{-1}$) and T (40°C) was needed to obtain satisfactory gelation parameters and in all cases > 95 % CMP was found to be released from the casein (CN) micelle prior to aggregation.

## INTRODUCTION

The composition of camel milk protein differs from milk of other species and CN micelles from camel milk have a larger average diameter (~380 nm) than bovine CN micelles[1]. The distribution of the different CNs is also substantially different, mainly in that camel milk has a smaller proportion of κ-CN (3.5% of the total CN ) and relatively much more β-CN (65% of total CN)[2] than bovine milk, where the proportions are 12% and 33%, respectively[3]. Until recently a suitable coagulant enzyme (i.e. camel chymosin) was not obtainable, hence very limited studies are available on κ-CN hydrolysis and gelation of camel milk.

## METHODOLOGY

The release of CMP was determined by size exclusion HPLC[4]. Rennetability and gelation of camel milk were followed using a free oscillating rheometer (ReoRox G2, Medirox, Nyköping, Sweden). Rate constant (K) for κ-CN hydrolysis was determined by fitting in to a first order kinetics model (*i.e.* $CMP = CMP_{\infty}(1 - e^{-Kt})$. Gelation time ($t_g$), time interval from $t_g$ until G' reached a value $(\frac{G'_{\infty}}{e})$ ($\tau$ ), G' value at t= ∞ ($G'_{\infty}$), were predicted using Scott Blair equation (i.e. $G' = G_{\infty} * e^{(-\tau/(t-t_g))}$. Where (t) is time after chymosin addition and (G') is storage modulus.

## RESULTS

Gelation of caseins started after > 95% CMP released from casein micelle. Variation in lag phase of gel development was observed for different levels of T (Fig. 1).

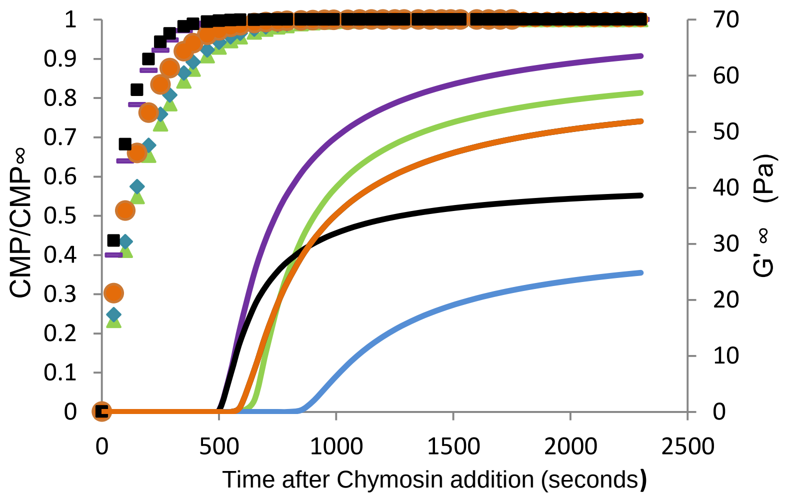


**Fig 1.** Effect of T, CC and pH on camel κ -CN hydrolysis and gelation (solid lines). T (♦) 30 °C and ((●) 40 °C, 55 IMCU $L^{-1}$) and CC (■) 85 IMCU $L^{-1}$; pH (▲) 6.6 and (—) 6.0.

The κ-CN hydrolysis rate has a negative correlation of 0.693 with $t_g$

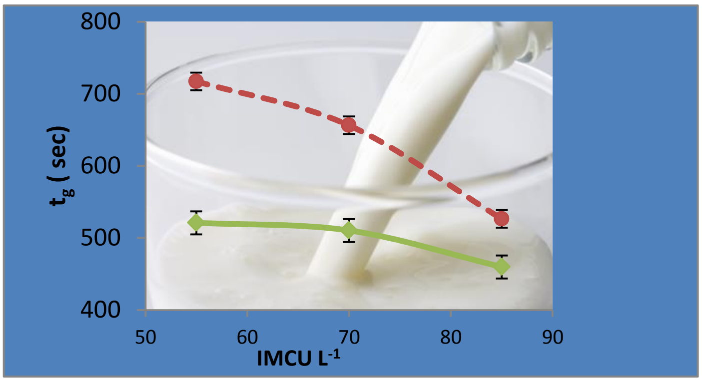


**Fig 2**. Gelation time ($t_g$) of camel milk as a function of T and CC. ... (30°C) & — (40 °C).

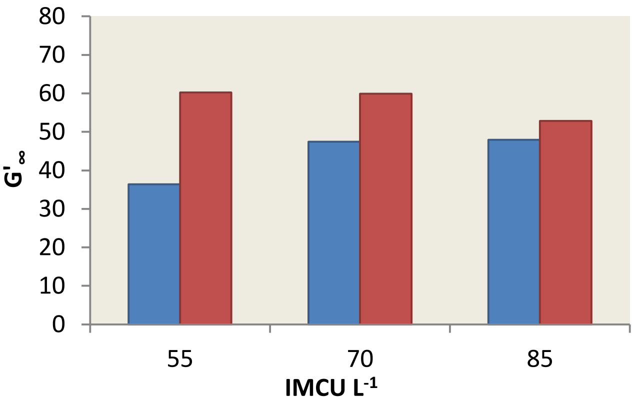


**Fig 3.** Storage module development at different T and CC. ■ 30 °C & ■ 40 °C.

## CONCLUSION

More than 95% of the CMP has to be released from the κ-CN of camel milk for the aggregation and gel formation to commence. The time of gelation was shown to be mainly affected by temperature ($t_g$ shorter at 40 than 30 °C) and by using a higher CC (85 IMCU $L^{-1}$) a comparable G'∞ was obtained irrespective of temperature.

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